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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,169	08/18/2003	Ping Hsu	10112751	3599

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QUINTERO LAW OFFICE
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EXAMINER

LE, THAO P

ART UNIT	PAPER NUMBER
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2818

DATE MAILED: 03/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/643,169

Applicant(s)

HSU, PING

Examiner

Thao P Le

Art Unit

2818

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 August 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,5 and 7-9 is/are rejected.
- 7) ☒ Claim(s) 3-4,6,10-14 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Acknowledge is made of applicants' claim for foreign priority base on an application 92108222 filed in Taiwan on 04/10/2003.

It is noted that Applicants have filled a certified copy of said application as required by U.S.C 119, which papers have been placed of record in the file.

Oath/Declaration

2. The oath/declaration filed on 8/18/03 is acceptable.
3. Claims 1-14 are pending in this application.

Objection of Specification

4. It appears that the word "impanation" in lines 15 and 23 of Page 8 should be changed to --- implantation ----.

Claim Rejections

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 1 is rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 1, line 10, "implantation area on the substrate" is not clearly defined the subject matter regarded as the invention. The ions implantation process is the process to implant or diffuse ions into the sidewall of the substrate (See Figs. 3B-3D) but does not add another layer on the substrate nor make the substrate thicker. Therefore, the word "on" is unclear, incorrect, and confused. The word "on" should be changed to, for example, ----in----

7. The remaining claims are dependent from the above rejected claims and therefore also considered indefinite.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1, 2, 5, 7-9 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Applicant Admitted Prior Art (AAPA) in view of Tsao, U.S. Patent No. 6,551,875.

Regarding to claim 1, AAPA (See **Figs. 1A-1B, 2A-2E and Pages 1-5**) discloses a method of forming a collar dielectric comprising the steps of:

- providing a semiconductor silicon substrate **10** having deep trench **DT** and a deep trench capacitor **12 (Fig. 1B)**, in which the deep trench capacitor comprises a node dielectric **16** formed on the sidewall and bottom of the deep trench and a storage node polysilicon **18** formed in the deep trench and reaching a predetermined depth (Pages 1-2);

- removing the node dielectric (**Fig. 2A**) until the top of the node dielectric is leveled off with the top of the storage node, thus exposing the sidewall of the deep trench outside the deep trench capacitor **12**;

- performing an oxidation process to grow a first silicon oxide layer **34 (Fig. 2B)** on the exposed sidewall of the deep trench.

However, AAPA fails to disclose the step of performing an ion implantation process to form an ion implantation area on the substrate at the top of the deep trench

before performing thermal oxidation to grow silicon oxide layer on the sidewall of the trench.

Tsao, in the other hand, discloses the method of forming collar dielectric (**See Figs. 1A-1E and Cols. 1-6**) including the steps of ion implanting (**Fig. 1D**) to form an ion implantation area in the substrate at the top of the deep trench **102**, and then performing an oxidation process to grow a first silicon oxide layer **114** (**Fig. 1E**) on the exposed sidewall of the deep trench, in which the first silicon layer is outside the ion implantation area (the implantation area is inside while the layer **114** is outside of the sidewall).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to perform an ion implantation process into the sidewall at the top of the deep trench as taught in Tsao in the method of AAPA **because** the ion implantation process would adjust oxide growth rates, provide a controllable growth rate of silicon oxide during thermal oxidation process in the later step to form a uniform collar silicon oxide layer (**Abstract, lines 40-55, Col. 3; lines 8-11, Col. 4**), thus, provide a high capacitance and integration for deep trench capacitors.

Regarding to claim 2, AAPA and Tsao disclose the claimed limitations as applied for claim 1 above, and Tsao further discloses the ion implantation process using

nitrogen as the ion source to restrain the growth of the first silicon oxide layer
(oxidation-suppressed dopant, nitrogen, lines 19-24, Col. 5).

Regarding to claim 5, AAPA and Tsao disclose the claimed limitations as applied for claim 1 above, and Tsao et al. further discloses wherein the ion implantation process entirely surrounds the top of the deep trench **(Fig. 1D, lines 55-67, Col. 3).**

Regarding to claim 7, AAPA and Tsao disclose the claimed limitations as applied for claim 1 above, AAPA further discloses the node dielectric 16 is a silicon nitride layer **(lines 11-12, Page 2).**

Regarding to claim 8, AAPA and Tsao disclose the claimed limitations as applied for claim 1 above, and AAPA further discloses the storage node 18 is an n+-type doped polysilicon layer **(lines 15-18, Page 2).**

Regarding to claim 9, AAPA and Tsao disclose the claimed limitations as applied for claim 1 above, and AAPA further discloses wherein the deep trench capacitor further comprises a buried plate which is an n+-type diffusion region formed in the substrate at the lower portion of the deep trench and surrounding the node dielectric **16 (Figs. 1B, 2A).**

Claim Objection

10. Claims 3, 4, 6, and 10-14 are objected.

Reasons for Indication of Allowable Subject Matter

11. Claims 3, 4, 6, 10-14 are **objected** to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, since the prior made of record and considered pertinent to the applicant's disclosure does not teach or suggest the claimed limitations. AAPA and Tsao (U.S. Patent No. 6,551,875), taken individually or in combination, do not teach the claimed invention having the method of forming collar dielectric including the step of ion implantation wherein the position and vertical length of the ion implantation area corresponds to those of a buried strap outdiffusion region (**claim 3**), wherein the ion implantation process partially surrounds a partial top of the deep trench and is adjacent to a buried strap outdiffusion region (**claim 4**), wherein the vertical length of the ion implantation area is 800-1500 Angstrom (**claim 6**), and further including the steps of forming a second silicon oxide layer on the sidewall of the deep trench to cover the first silicon oxide layer and the ion implantation area, etching the second silicon oxide layer and the first silicon oxide layer to level off the top of the second silicon oxide layer and the top of the first silicon oxide layer but the combination of the second silicon oxide layer and the first silicon oxide layer remaining on the sidewall of the deep trench serve as a collar dielectric layer (**claims 10-11**).

12. If Applicants are aware of better art than that which has been cited, they are required to call such to attention of the examiner.

13. When responding to the office action, Applicants' are advice to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.

A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure..

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao P Le whose telephone number is 571-272-1785. The examiner can normally be reached on M-T (8:00-6:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **David Nelms** can be reached on 571-272-1787. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'Thao P. Le'. The signature is stylized with a large, looped 'T' and a cursive 'Le'.

Thao P. Le